Botanists will be glad to have the author's assurance that a more extended and technical account of the living cycads is in preparation. In the present pocket volume of 172 pages the author has done a useful piece of work and has done it well.—M. A. CHRYSLER.

## NOTES FOR STUDENTS

**Inheritance in Pediastrum.**—Practically all of our present knowledge of inheritance in the plant kingdom is based upon work done with flowering plants, regularly involving the sex act. The sex act in flowering plants, furthermore, is peculiarly obscured; we cannot be altogether certain what happens between the time of pollination and seed germination. We think that the program followed is a remarkably regular one, but we feel that frequently irregularities may occur, and we know that sometimes they do. We wish therefore to know what all of these irregularities are, how they affect inheritance, and how they may be induced or controlled artificially. It has long been felt that a study of inheritance in simple plants would be suggestive, for in them many of the complexities surrounding reproduction are stripped away. The sex act takes place "in the open," so that there is more hope of absolute control; some forms even lie "below the level of sex," furnishing unusual material for "pure line" work; and germ plasm seems identical with body plasm. The direct bearing of such a study upon practical genetics may be negligible, but upon theoretical genetics it promises to be profound.

HARPER[2] has been working with cultures of *Pediastrum*, and has developed some very significant ideas. He considers 3 "degrees of directness" of inheritance in *Pediastrum:* (1) direct transmission, as by division of plastids; (2) the more indirect transmission of those adult cell characters (as cell form) which are not visibly present as such in the germ cell; (3) the entirely indirect transmission of the characters of the many-celled organism as a whole (as colony form). The adult cell characters which HARPER observed "do not suggest the working out of influences emanating from elements in the chromosomal organization of the nucleus, but rather the direct expression of the organization of the cell as a whole when it begins to grow," involving specific polarities, surface tension, etc. These cell characters come into expression whether or not the colony is successfully formed. Colony characters, therefore, are dependent upon individual cell characters, rather than the reverse. "If in the swarming period the cell does not achieve its normal position . . . . the maladjustment is never overcome."

Thus the author paints for us two distinct pictures, which should be considered separately. First, the picture of inheritance through specific polarities, etc., of protoplasts as a whole, rather than determiners located on

[2] HARPER, R. A., Organization, reproduction, and inheritance in *Pediastrum*. Proc. Amer. Phil. Soc. **66**:375–439. *pls. 5, 6. figs. 54.* 1918.

chromosomes. This may be a rather general situation among the simpler plants, where germ plasm and body plasm are merged. Whether it is at all applicable to higher plants is questionable. Perhaps the "phylogenetic age" of the latter has brought this difference of body plasm and germ plasm, involving a rigid chromosome mechanism.[3] The other picture is "that the swarming period . . . . is not one of aimless movement . . . . but a definitely directed effort to achieve for each cell a specific relation to its fellows." Successful achievement means normal colonies; otherwise monstrosities result. This situation could apply only to a very limited number of cases, even among the lower plants. Among higher plants a vivid imagination might attempt to apply it to the free nuclear stage in the embryo formation of gymnosperms, or in the organization of the embryo sac of angiosperms. The author, however, does not carry his ideas beyond *Pediastrum*, where they seem quite appropriate and well founded. Similarly careful work upon less peculiar types of algae should yield even more profitable suggestions.—MERLE C. COULTER.

**Mendelian inheritance in gametophytes.**—One of the most critical tests of the current theoretical mechanism for inheritance lies in the behavior of the gametophyte generation in inheritance. If our Mendelian mechanism is correct, gametophytes should show predictable peculiarities; segregation should take place in the first hybrid generation, and dominance should be out of the question. Such an investigation is not particularly hopeful among angiosperms, owing to the insignificance of the gametophytes. In fact it is a rather general opinion that "the characters which they possess appear to be wholly sporophytic, the factors which they carry functioning only after fertilization."[3] BELLING[4] explains semi-sterility in beans on the basis of the germinal equipment of the gametophytes upon the gametophytes themselves, but this merely involves lethal effects.

More hopeful material is provided by the lower plants, where the gametophyte generation is more prominent and really has characters of its own. TRANSEAU[5] reports hybridization in *Spirogyra*, and it is significant that he can give it a Mendelian interpretation. Unfortunately the work is as yet merely observational rather than experimental. Hybridization was observed taking place in nature between *S. communis* and *S. varians*, *S. varians* and *S. porticalis*. The 3 species involved showed distinguishing characters in the shape and size of the vegetative cells, and the shape and orientation of the zygotes. The auther looked in the immediate vicinity, therefore, for possible hybrids resulting from these crosses which should display new combinations of the parental

[3] EAST, E. M., and PARK, J. B., Studies on self-sterility. I. The behavior of self-sterile plants. Genetics 2:525–609. 1917.

[4] BELLING, JOHN, Lethal factors and sterility. Jour. Heredity 9:161–165. 1918.

[5] TRANSEAU, EDGAR NELSON, Hybrids among species of *Spirogyra*. Amer. Nat. 53:109–119. *figs.* 7. 1919.